Market Impact Analysis of Potential Changes to the ENERGY STAR® Criteria for Clothes Washers

Background

Both the federal clothes washer standard and the ENERGY STAR clothes washer criteria changed on January 1, 2004. The federal standard changed by switching from a minimum Energy Factor of 2.50 to a minimum Modified Energy Factor (MEF) of 1.04[1]. The ENERGY STAR criteria for clothes washers changed from a minimum MEF of 1.26 to a minimum MEF of 1.42.

On January 1, 2007, the federal standard will increase again to an MEF of 1.26. With this, a change in the ENERGY STAR criteria may be necessary in order to maintain significant energy savings between ENERGY STAR qualified clothes washers and those that meet the federal standard. If changed, the objectives of the revised ENERGY STAR criteria would be to:

- Provide enough differentiation between ENERGY STAR qualified products and those that just meet the federal standard in order to protect the value of the ENERGY STAR brand.
- Provide an economic rationale for both consumers to invest and for utilities and other investors in ENERGY STAR promotions to demonstrate a public benefit associated with participation.
- Examine ways in which ENERGY STAR qualified models could produce significant water savings in order to attract the support of water utilities and other stakeholders interested in investing in water efficient products.

Several ENERGY STAR utility and regional efficiency partners have recommended including a maximum water factor requirement for ENERGY STAR qualified clothes washers. Currently, the ENERGY STAR criteria only set maximum consumption levels for energy. In some cases, an ENERGY STAR qualified clothes washer can use as much water as a non-qualified model. Adding a water factor requirement should assure that qualified models save both energy and water.

Market Overview

Clothes washers have been included in the ENERGY STAR program since 1997. When the program first expanded to include clothes washers, there were very few qualified products available, with smaller European manufactured models producing the majority of qualified products. In June 1997, Maytag introduced the Neptune, a horizontal axis clothes washer. It was the first ENERGY STAR qualified clothes washer produced by one of the large U.S. manufacturers.

Until the introduction of the Neptune, ENERGY STAR qualified clothes washer market penetration was less than one percent. But after the introduction of the Neptune and other qualified models, market penetration increased to almost five percent. This success helped drive more clothes washer

[1] MEF is an efficiency metric that accounts for projected dryer usage based on remaining moisture content (RMC). In order to derive the MEF, a new test procedure outlined in Appendix J1 to Subpart B of Part 430 in Title 10 of the Code of Federal Regulations (CFR) is used. The new test procedure, called the Appendix J1 test procedure, replaced the old Appendix J test procedure.

manufacturers to produce and qualify new products, spurring utility and regional efficiency groups to offer rebates and incentive promotions on qualified washers. These activities resulted in an increase in the ENERGY STAR market penetration to its current level of nearly 28 percent.

On January 1, 2001, the ENERGY STAR criteria began using the MEF as defined in the Appendix J1 test procedure. Table One shows the change in average MEF level over time since the introduction of the Appendix J1 test procedure. The average MEF has risen substantially since the new test procedure took effect and there are many more qualified products above the average MEF. There was a slight dip in the average MEF due to the introduction of several new models at the minimum ENERGY STAR level in the first six months of 2004.

Table One: Average MEF levels for ENERGY STAR qualified clothes washers by year

Date	*Average MEF*	*Number of Qualified Products Above Average*
January 1, 2001	1.65	23
January 1, 2002	1.65	33
January 1, 2003	1.70	38
January 1, 2004	1.74	45
June 30, 2004	1.73	77

ENERGY STAR qualified clothes washers exist in both horizontal axis (front loading in most cases) and vertical axis (top loading) styles. Under the old Appendix J test procedure, it was virtually impossible to meet the ENERGY STAR criteria without using substantially less water than a non-qualified model since approximately 90% of the energy used by a clothes washer is used to heat the water. With the new Appendix J1 test procedure, the inclusion of dryer energy makes it possible for an ENERGY STAR qualified clothes washer to use almost as much energy and water as a non-qualified model as long as the remaining moisture content is very low. Models accomplish the low remaining moisture contents through very high spin speeds. These models will save substantial energy through shorter drying times, but the savings are only realized when the dryer energy is included.

Potential ENERGY STAR Criteria Performance Levels

As of June 30, 2004, there are 171 ENERGY STAR qualified clothes washers and every leading manufacturer has several qualified products. Currently, the minimum ENERGY STAR MEF of 1.42 is 36% above the federal standard of 1.04. This criterion was set in order to attempt to capture approximately 25% of all available models. If ENERGY STAR wants to keep the criterion at a similar level above the 2007 federal standard and set it 36% above the federal standard, then ENERGY STAR would need to raise the MEF to 1.71. This MEF would include approximately half of all models that are currently qualified and approximately 25% of all models that are currently manufactured. Table Two provides a view on how the current qualified clothes washers fall under a range of MEF levels.

Table Two: ENERGY STAR and Federal Performance Levels – MEF Level Only

Minimum Modified Energy Factor (MEF)	*Number of Qualified Products Available (as of June 30, 2004)*
1.42	171
1.55	116
1.60	109
1.65	100
1.70	84
1.71	82
1.75	69
1.80	64
2.00	23

With the addition of a water factor requirement (see Table Three), there would be fewer qualified models at each MEF level. Including a maximum water factor of 9.5 as part of the current ENERGY STAR criteria would cause 36 models to drop of the qualified product list. The initial water factor levels were drawn from the Consortium for Energy Efficiency (CEE) Clothes Washer High Efficiency specifications and supplemental levels were added. For water savings, a baseline water usage of 14,468 gallons of water was used based on the average water consumption of non-qualified products in the ENERGY STAR product database[2]. The average tub capacity was assumed to be 2.7 cubic feet.

[2] D&R International.

Table Three: Number of Qualified Products and Potential Savings at Various Levels – MEF and Water Factor

Minimum Modified Energy Factor (MEF)	Maximum Water Factor	Qualified Products Available (as of June 30, 2004)	Average Volume (cubic feet)	Number of Original Equipment Manufacturers	Approximate Savings Compared to Federal Standard[3]		CEE Tier
					Electric (kWh/year)	Water (gallons per year)	
1.42	9.5	135	2.6	13	207	4,251	Tier 1
1.60	9.5	102	2.6	13	244	4,913	
1.60	8.5	82	2.6	11	244	5,485	Tier 2
1.60	7.5	63	2.6	10	244	6,270	
1.60	6.5	54	2.7	8	244	6,388	
1.70	9.5	77	2.6	12	255	5,245	
1.70	8.5	68	2.7	12	255	5,578	
1.70	7.5	56	2.6	9	255	6,244	
1.70	6.5	48	2.7	8	255	6,359	
1.71	9.5	75	2.6	12	257	5,231	
1.71	8.5	66	2.6	11	257	5,571	
1.71	7.5	54	2.6	10	257	6,261	
1.71	6.5	46	2.7	8	257	6,383	
1.80	9.5	61	2.6	10	262	5,640	
1.80	8.5	58	2.6	10	262	5,756	
1.80	7.5	50	2.6	9	262	6,256	Tier 3A
1.80	6.5	43	2.7	7	262	6,370	
1.80	5.5	34	2.9	5	262	6,702	Tier 3B
2.00	5.5	17	2.7	4	280	6,702	

Engineering Considerations

According to the current testing procedure, the most efficient model in terms of Modified Energy Factor has an MEF of 2.66 and a water factor of 7.3. The top model with a water factor of less than 5.5 has an MEF of 2.2. Chart One on page 6 shows a regression analysis of MEF and water factor using all current ENERGY STAR qualified clothes washers. Water factor *tends* to decrease with

[3] D&R International.

higher MEF values, but as the regression analysis shows, with the J1 test procedure, the correlation is not very strong and there are many exceptions. Therefore, raising the minimum MEF level to reduce water usage would not be an effective approach and a separate water factor requirement would be needed.

Each proposed performance level creates some technical limitations for a number of the manufacturing partners. Within the highest MEF level of 2.00, there is currently only one model manufactured by a major manufacturer[4]. This model has a water factor of 5.87, so it would not qualify for the highest level listed on table 3. The 1.8 MEF level and CEE's top tier of 3B currently feature models from two of the four major manufacturers. Each whole number drop in the maximum water factor saves approximately 1000 gallons of water per year per unit.

Potential Energy Savings

Tables 4, 5, and 6 below show the estimated savings for three scenarios of raising the MEF requirement for ENERGY STAR. Each table assumes a 20% market penetration to show the potential national energy savings of an appropriate criteria change at the given MEF requirement. The first scenario outlines the impact of an ENERGY STAR MEF of 1.6, the second scenario shows an MEF of 1.7 and the third scenario shows an MEF of 1.8.

Full year 2003 shipments of 8.15 million units were used to estimate total clothes washer sales. The baseline kWh/year was determined based on a model meeting the 2007 federal minimum MEF of 1.26. The ENERGY STAR kWh/year assumes the average kWh/year for products currently above each level.

Table 4: MEF of 1.6 and 20% ENERGY STAR Market Penetration Savings

ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit (kWh/yr)	National Aggregate (MWh/yr)
1,629,160	463	219	244	397,515

Table 5: MEF of 1.7 and 20% ENERGY STAR Market Penetration Savings

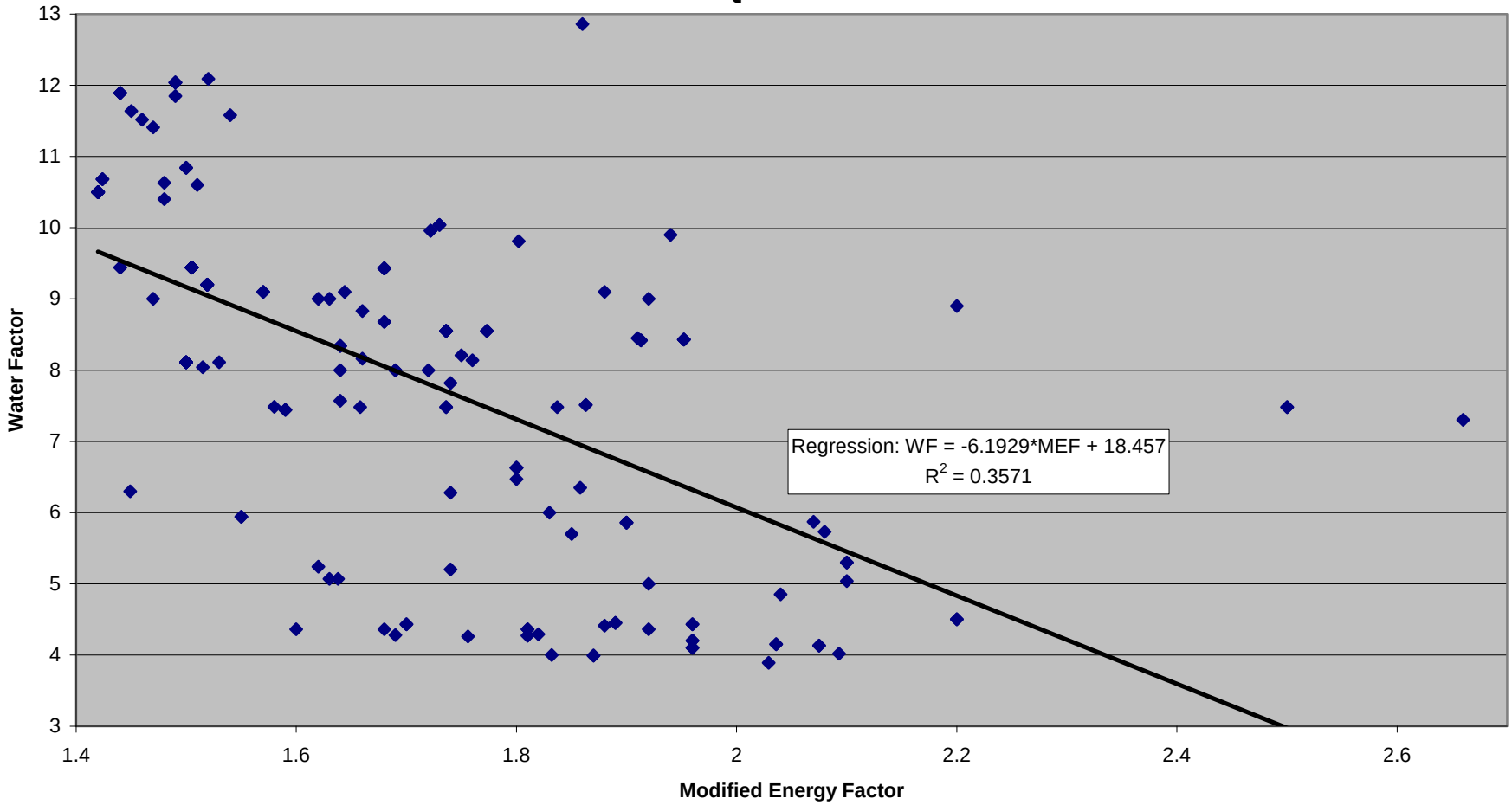
ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit, kWh/yr	National Aggregate (MWh/yr)
1,629,160	463	208	255	415,436

Table 6: MEF of 1.8 and 20% ENERGY STAR Market Penetration Savings

ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit, kWh/yr	National Aggregate (MWh/yr)
1,629,160	463	201	262	426,840

[4] Major manufacturers are defined as Whirlpool, Maytag, GE Appliances and Electrolux since they control more than 99% of the United States market as of 2002 according to Appliance Magazine.

Chart One: Correlation of Water Factor (WF) and Modified Energy Factor (MEF) for ENERGY STAR Qualified Clothes Washers



Summary

Since the inclusion of clothes washers into the ENERGY STAR program, the Department of Energy has worked with stakeholders to insure the criteria continues to offer consumers significant energy savings while helping to encourage new energy efficient technologies into the appliance market place. This was once again achieved in 2004 when ENERGY STAR increased the criteria to 1.42 MEF causing many of the models with the highest water and energy usage to no longer qualify while maintaining a very healthy nationwide market share.

Reviewing potential clothes washer criteria offers an opportunity for stakeholders to comment on both energy and water efficiency possibilities. By discussing suitable MEF and water factor levels, utilities and other partners concerned about water usage could use the ENERGY STAR program as a way to promote the conservation of all resources. Moreover, the addition of a water factor requirement could allow for a more extensive partner network to include water utilities and provide an umbrella for which to promote resource efficient clothes washers. The Department of Energy looks forward to receiving all comments regarding this opportunity.

This analysis is based on an examination of currently available models and makes no attempt to predict technological advancements between now and 2007 when the Federal standard is increased. Manufacturers have over two years to meet the new Federal standard.

The Department of Energy will be hosting a public hearing to discuss all issues related to the ENERGY STAR clothes washer criteria on August 31, 2004 in Washington, DC. Any comments prior to this meeting can be submitted to Richard Karney at Richard.Karney@EE.DOE.GOV.